Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Supporting Information

Reduced graphene oxide/polyaniline hybrid: preparation, characterization and its applications for ammonia gas sensing

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The elemental compositions of different particles have been analyzed by energy dispersive X-ray analysis (EDX), and the results were shown in Fig. S1. As for the RGO/MnO_2 hybrids, the peaks of Mn can be clearly observed (as shown in Fig. S1a), which suggests that the formation of MnO_2 on the surface of RGO sheets have been successfully achieved. After dissolved by H_2SO_4 aqueous solution, the Mn^{2+} has been formed and totally removed. As shown in Fig S1b, the peaks of Mn have been disappeared, and a new peak of S has been existed. This spectrum is similar with that of PANI nanofibers (as shown in Fig. S1c), suggesting that the PANI has been successfully doped with H_2SO_4.

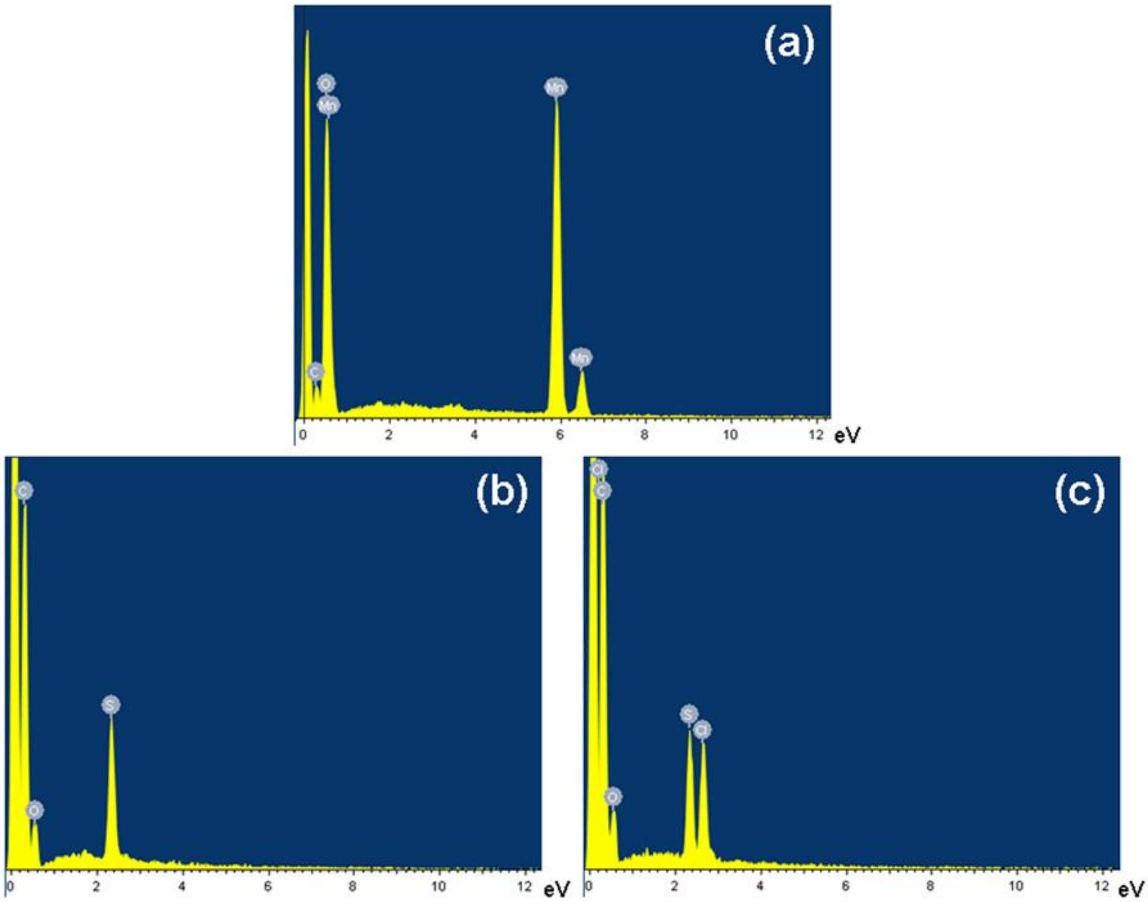

Fig. S1 EDX spectra of (a) RGO/MnO_2, (b) RGO/PANI hybrids, and (c) PANI nanofibers.

In order to illustrate the effect of PANI on the ammonia (NH_3) sensing properties of RGO sheets, we treated the RGO/PANI hybrids according to the methodology demonstrated by L. Q. Xu. [1] Typically, the RGO/PANI hybrids were de-doped with 1 M NH_3 aqueous solution, and the majority of PANI was removed by filtering the suspension through G5 sintered glass and washed with plenty of N-methyl-2-pyrrolidone (NMP), and as a result, the de-doped PANI molecules attached RGO sheets were obtained. Since the PANI molecules had been de-doped, the PANI molecules (Emeraldine base state) were insulated, i.e., the circuit networks of sheets were totally dependent on the RGO sheets. This was benefit for the study of the effect of PANI on the sensing properties of RGO sheets.

For the purpose of comparison, the sensing device based on de-doped PANI molecules attached RGO sheets (noted as sensor-4) was fabricated according to the protocol mentioned in the Experimental section. The dynamic response of the resultant sensor toward NH_3 gas under the concentration of 50 ppm were tested and displayed in Fig. S2. Similar with the devices based on bare RGO (noted as sensor-1), PANI nanofibers (noted as sensor-2) and the hybrids (noted as sensor-3), the resistances of the sensor-4 increase significantly as the NH_3 gas was released to the chamber. About 30 % change of the resistance could be achieved for the sensor-4, which was better than those of sensor-1 and sensor-2. Since the de-doped PANI molecules were not conductive, and the response of the device was improved rapidly, we could conclude that the interaction of PANI molecules and RGO sheets played important roles on the final response of RGO sheets as well. PANI, as a conducting polymer, can interact with RGO sheets through π-π interaction.[2] During the sensing process, the electron transfer may occur between the conjugated polymer and RGO sheets, and consequently increase the sensing performance of the resultant hybrids.[3]

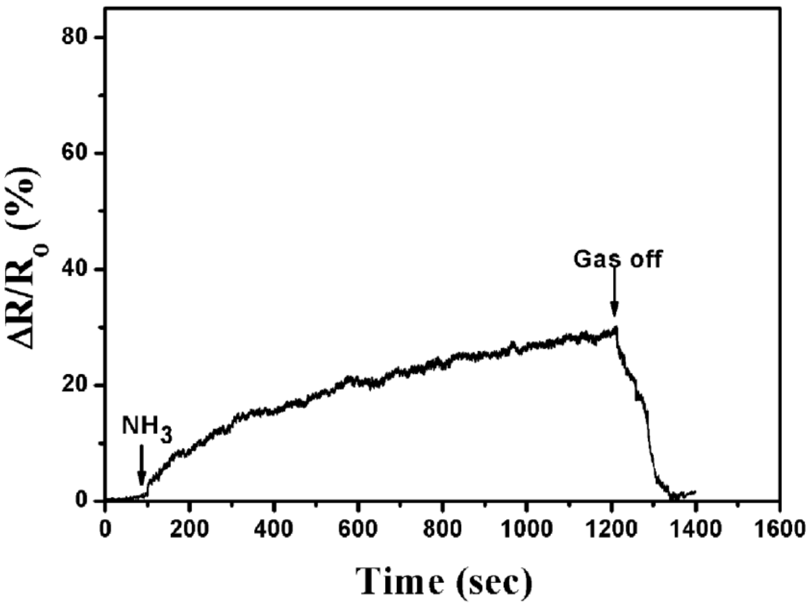

Fig. S2 The response curve of RGO anchored with de-doped PANI molecules to NH_3 gas under the concentration of 50 ppm.

References
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